Supplemental File 2: List of equations cited by included studies.

Study	Equation	Notes
ACSM, 1980 [1]	Unknown	There are no clear equations displayed within appendices, or throughout text, so it is unknown how authors citing this book would have established a %pred value.
Åstrand & Rodahl, 1977 [2]	Unknown	There are no clear equations displayed within appendices, or throughout text, so it is unknown how authors citing this book would have established a $\%_{pred}$ value.
ATS/ACCP, 2003 [3]	Female: VO_{2max} ($mL{\cdot}min^{-1}$) = (weight + 43) x (22.78 − (0.17 age)[a] Male: VO_{2max} ($mL{\cdot}min^{-1}$) = weight x (50.75 − 0.372 age)[b] Female & Male: VO_{2max} ($L{\cdot}min^{-1}$) = 0.046 (height) – 0.021(age) – 0.62(sex) – 4.31[c]	Article states that: "*This section [within article] addresses issues related to reference values for normal sedentary North American subjects*" and despite providing a table with 12 different sets of normative values that predict VO_{2max}, concludes that "*In the interim and until a new set of "optimal" reference values are available, the committee considers that the two most widely used sets of references values—Jones and coworkers and Hansen and coworkers should continue to be used clinically*" – referring to Jones et al., 1985 [4] and Hansen et al., 1984 [5]. a) Formula supposedly from Hansen et al., 1984 [5], but as noted below, there is no equation for female VO_{2max} in the original manuscript. From Table 15 in ATS/ACCP, 2003. Weight in kg. b) Formula from Hansen et al., 1984 [5], provided in Table 15 of ATS/ACCP, 2003. Weight in kg. c) Formula from Jones et al., 1985 [4], provided in Table 14 of ATS/ACCP, 2003. Height in cm; sex coded 1(F) or 0(M).
Binkhorst et al., 1986 [6]	Female: VO_{2max} ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$) = 17.0 + 2.43 T_{max} [a] VO_{2max} ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$) = 34.2 + 1.29 T_{170} [a] Male: VO_{2max} ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$) = 19.6 + 2.43 T_{max} [a] VO_{2max} ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$) = 39.4 + 1.29 T_{170} [a] Female & Male: $\ln VO_{2max}$ ($L{\cdot}min^{-1}$) = 0.162 + 0.00484 W_{max} [b] $\ln VO_{2max}$ ($L{\cdot}min^{-1}$) = -0.145 + 0.0058 W_{170} [b]	143M/136F, even year groups, aged 6-18y. All children underwent treadmill testing (Bruce protocol). Only children from 12-18 years (75M/79F) underwent cycle ergometry. a) Equations from treadmill testing. b) Equations from cycle ergometry. T_{max}: Maximal time T_{170}: Time at heart rate of 170 beats per minute. W_{max}: Maximal workload W_{170}: Workload at heart rate of 170 beats per minute

Study	Equation	Notes
Binkhorst et al., 1992 [7]	Female: VO_{2max} ($mL \cdot kg^{-1} \cdot min^{-1}$) = 60.0 – 0.10 HR_6 [a] VO_{2max} ($mL \cdot kg^{-1} \cdot min^{-1}$) = 17.0 + 2.43 T_{max} [a] Male: VO_{2max} ($mL \cdot kg^{-1} \cdot min^{-1}$) = 72.8 – 0.16 HR_6 [a] VO_{2max} ($mL \cdot kg^{-1} \cdot min^{-1}$) = 19.6 + 2.43 T_{max} [a] Female & Male: VO_{2max} ($L \cdot min^{-1}$) = 0.18 + 0.011 W_{max} [b] VO_{2max} ($L \cdot min^{-1}$) = -0.05 + 0.012 W_{max} [c]	336 boys and girls (exact split not known). All children underwent treadmill testing (Bruce protocol). Children aged ≥12 years underwent cycle ergometry in addition. a) Equations from treadmill testing. b) Equations from cycle ergometry for 12-14 year olds. c) Equations from cycle ergometry for 16-18 year olds. HR_6: Heart rate in 6th minute of test T_{max}: Maximal time W_{max}: Maximal workload
Bongers et al., 2012 [8]	Unknown	This edition of Bongers et al., 2012 [8] utilises boys and girls as per Bongers et al., 2014 [9], who underwent cycle ergometry. However, no explicit equations are given in this edition of the book (unlike Bongers et al., 2014 [9]), and therefore as the exact method for deriving %pred for VO_{2max} is unknown.
Bongers et al., 2014 [9]	Female: VO_{2peak} ($L \cdot min^{-1}$) = (-0.0022 x age^2) + (0.2184 x age) – 0.4727 VO_{2peak} ($mL \cdot kg^{-1} \cdot min^{-1}$) = (-0.0025 x age^3) +(0.064 x age^2) – (0.1483 x age) + 37.968 Male: VO_{2peak} ($L \cdot min^{-1}$) = (0.0033 x age^2) + (0.1316 x age) + 0.084 VO_{2peak} ($mL \cdot kg^{-1} \cdot min^{-1}$) = (-0.0015 x age^3) – (0.0321 x age^2) + (1.8851 x age) + 33.355	Data derived from n = 214 healthy Dutch children (114M/100F), aged 8-18 years. Exercise performed via cycle ergometry, using Godfrey protocol.
Cooper & Weiler-Ravell, 1984 [10]	Female: VO_{2max} ($mL \cdot min^{-1}$) = 22.5 height – 1837.8 Male: VO_{2max} ($mL \cdot min^{-1}$) = 43.6 height – 4547.1 Female & Male: VO_{2max} ($mL \cdot min^{-1}$) = 37.1 height – 3770.6	Height in cm. Data derived from 109 children (58M/51F), aged 12 (± 3) years, range 6-17 years, performing cycle ergometry. Study also compares against existing equations from Astrand, 1952 [11]: Female: VO_{2max} = 32.6 height – 2820.3 Male: VO_{2max} = 46.4 height – 4610.6 Female & Male: VO_{2max} = 40.4 height – 3846.0

Study	Equation	Notes
Cooper et al., 1984 [12]	Female: VO_{2max} (mL·min^{-1}) = 28.5 weight + 288.2 Male: VO_{2max} (mL·min^{-1}) = 52.8 weight – 303.4 Female & Male: VO_{2max} (mL·min^{-1}) = 45.6 weight – 197.9	Weight in kg. Data derived from 109 children (58M/51F), age range 6-17 years, performing cycle ergometry.
Drinkwater et al., 1975 [13]	VO_{2max} (L·min^{-1}) = 2.46 – 0.016 age ^{a} VO_{2max} (mL·kg^{-1}·min^{-1}) = 83.663 – 4.114 age + 0.127 age^2 – 0.0012 age$^{3\ b}$ VO_{2max} (mL·kg^{-1}·min^{-1}) = 71.237 – 3.524 age + 0.104 age^2 – 0.0010 age$^{3\ a}$ VO_{2max} (mL·kgLBM^{-1}·min^{-1}) = 90.684 – 3.808 age + 0.118 age^2 – 0.0011 age$^{3\ b}$ VO_{2max} (mL·kgLBM^{-1}·min^{-1}) = 88.99 – 4.459 age + 0.140 age^2 – 0.0014 age$^{3\ a}$	Data derived from n = 109 women, aged 10-68, although women aged 60 and above were excluded from analyses because of small number within this age group. For data analysis and derivation of equations, subjects were divided into two groups, either above or below the combined age group means reported for Canadian and Scandinavian women in Shephard, 1966 [14]. a) For women below age group mean. b) For women above age group mean.
Edvardsen et al., 2013 [15]	Female: VO_{2max} (L·min^{-1}) = 3.31 – 0.022 year VO_{2max} (mL·kg^{-1}·min^{-1}) = 48.2 – 0.32 year Male: VO_{2max} (L·min^{-1}) = 4.97 – 0.033 year VO_{2max} (mL·kg^{-1}·min^{-1}) = 60.9 – 0.43 year	Data derived from n = 759 (394M/365F) Norwegian adults, aged 20-85 years. Exercise performed on a treadmill, using a modified Balke protocol.

Study	Equation	Notes
ERS, 1997 [16]	Female: VO_{2peak} (mL·min^{-1}) = (22.78 – 0.17 age) (weight + 43) [a] VO_{2peak} (L·min^{-1}) = 0.046 height – 0.021 age – 4.93 [b] VO_{2peak} (L·min^{-1}) = 0.0142 height – 0.0115 age + 0.00974 weight + 0.651 [c] VO_{2peak} (L·min^{-1}) = 0.0158 height – 0.027 age + 0.00899 weight + 0.207 [d] Male: VO_{2peak} (mL·min^{-1}) = (50.75 – 0.372 age) weight [a] VO_{2peak} (L·min^{-1}) = 0.046 height – 0.021 age – 4.31 [b] VO_{2peak} (L·min^{-1}) = 0.0142 height – 0.0494 age + 0.00257 weight + 3.015 [c] VO_{2peak} (L·min^{-1}) = 0.023 height – 0.031 age +0.0117 weight – 0.332 [d]	ERS states that: "analysis of potential studies in healthy sedentary people providing prediction equations for peak VO_2 obtained with incremental cycling exercise testing is reduced to three sets [Hansen, Jones, Fairbarn]. Basic characteristics of these three studies are summarized in table 7". However, Table 7 (in which equations are displayed) goes on to display the four sets listed below. a) From Hansen et al., 1984 [5] and Wasserman et al., 1994 [17]. Age in years. Weight in kg. NB. The table within ERS, 1997 [16] acknowledges that the derivation sample for Hansen et al., 1984 [5] solely consists of males aged 34-74 years. b) From Jones et al., 1985 [4]. Height in cm. Age in years. c) From Blackie et al., 1989 [18]. Height in cm. Age in years. Weight in kg. Derivation sample of n = 128 (47M/81F), aged >55 years. d) From Fairbarn et al., 1994 [19]. Height in cm. Age in years. Weight in kg. Derivation sample of n = 231 (111M/120F), 20-80 years.
Froelicher et al., 1974 [20]	Male: VO_{2max} = 45.7 – 0.27 age [a] VO_{2max} = 11.2 + 1.54 TT [b]	Data derived from n = 710 males, aged 20-53 years, undergoing treadmill testing using Balke protocol. All participants from US military. a) Age in years. b) TT = Treadmill time in minutes.
Godfrey et al., 1971 [21]	Unknown	This study, completed on n = 117 children (57M/60F), aged 6.0-15.9 years, using cycle ergometry, derived regression coefficients (and therefore equations) for prediction of W_{max}, but not VO_{2max}. Part of this investigation had children perform steady state exercise at 1/3 and 2/3 of W_{max}, and regressions (and therefore equations) are available for prediction of VO_2 during this bout of submaximal exercise.
Gulmans et al., 1997 [22]	Unknown	This study, completed in n = 158 children (77M/81F), aged 12-18 years, using cycle ergometry, derived regression coefficients (and therefore equations) for prediction of W_{max} as an absolute value, and relative to body mass and fat free mass. No equations for prediction of VO_{2max} are provided.

Study	Equation	Notes
Hansen et al., 1984 [5]	Male: VO_{2max} (mL·min^{-1}) = weight x (50.75 − 0.372 age)	Data in this study is derived from 77 male shipyard workers, aged 54.3 (± 9.2) years, ranging from 34-74 years. Cycle ergometry was performed in this group. The equation given for males is established a priori, for validation in this cohort, and is stated to be: "*90% of Bruce's treadmill VO_{2max} values in his sedentary male population*", referring to Bruce et al., [23]. However, the work of Bruce et al., [23] is conducted on a treadmill and it is not clear how the 90% threshold has been chosen, nor calculated. Therefore, modality cannot be confirmed from this study and any study citing Hansen et al., [5] cannot be verified as modality-appropriate – and is listed as 'unsure' – for purposes risk of bias. Moreover, this work of Hansen et al., [5] is also cited in several documents such as ATS/ACCP, 2003 [3] and ERS, 1997 [16], which also provides the equation for females below: VO_{2max} (mL·min^{-1}) = (weight + 43) x (22.78 − (0.17 age) However, as the original work of Hansen et al., [5] is undertaken exclusively in males, it is not known how this female equation has been derived and therefore any studies to use females and cite Hansen et al., [5] cannot be verified as a being sex-appropriate – and is listed as 'partial' – for purposes of risk of bias. Weight is in kg.
Hermansen, 1973 [24]	Unknown	Reference is dated 1973 in citation and on PubMed (PMID 4522516). However, Suppl 399 on journal website is dated 1974. Authors have assumed this is the same article as there is no evidence to the contrary. Separate mean data is provided for males and females, from ages 11-16 as shown in Tables 5 & 6 of Appendix of reference, but no clear equations for predicting VO_{2max} are present. Modality not clear from reference.

Study	Equation	Notes
Jones & Campbell, 1982 [25]	Female: VO_{2max} ($L{\cdot}min^{-1}$) = 2.6 – 0.014 age VO_{2max} ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$) = 48 – 0.37 age Male: VO_{2max} ($L{\cdot}min^{-1}$) = 4.2 – 0.032 age VO_{2max} ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$) = 60 – 0.55 age	Within this book, Appendix D explicitly states the given equations for adult males and females aged 20 and above. These equations are derived from data obtained in Europe, Scandinavia, and North America as per Astrand 1956 [26], Astrand 1960 [27], Lange-Anderson et al., 1971 [28] and Shephard 1969 [29]. For children aged 8 and above with normal body fat, Appendix D within this book also suggests VO_{2max} may be predicted using a factor of 50 mLO_2/kg/min (M) and 45 mLO_2/kg/min (F) from age 8 upwards. This recommendation comes from Lange-Anderson et al., 1971 [28]. Modality not clear from reference.
Jones et al., 1985 [4]	Female: VO_{2max} ($L{\cdot}min^{-1}$) = 0.025 height – 0.018 age + 0.010 weight – 2.26 Male: VO_{2max} ($L{\cdot}min^{-1}$) = 0.034 height – 0.028 age + 0.022 weight – 3.76 Female & Male: VO_{2max} ($L{\cdot}min^{-1}$) = -0.624 sex + 0.046 height – 0.021 age – 4.31 VO_{2max} ($L{\cdot}min^{-1}$) = -0.492 sex + 0.032 height – 0.024 age + 0.019 weight – 3.71	In equations applicable to both males and females, sex is coded 0 for males and coded 1 for females. For all equations, height is in cm, age in years, weight in kg. Data derived from cycle ergometry in 50 males and 50 females, aged from 15-71 years.

Study	Equation	Notes
Jones, 1988 [30]	Female: VO_{2max} (L·min^{-1}) = (48 – 0.37 age) x 0.01 weight [a] VO_{2max} (L·min^{-1}) = 3.01 height – 0.017 age – 2.56 VO_{2max} (L·min^{-1}) = 2.49 height – 0.018 age + 0.010 weight – 2.26 VO_{2max} (L·min^{-1}) = 2.25 height – 1.84 [b] VO_{2max} (L·min^{-1}) = 0.029 weight – 0.29 [c] Male: VO_{2max} (L·min^{-1}) = (60 – 0.55 age) x 0.01 weight [a] VO_{2max} (L·min^{-1}) = 5.41 height – 0.025 age – 5.66 VO_{2max} (L·min^{-1}) = 3.45 height – 0.028 age + 0.022 weight – 3.76 VO_{2max} (L·min^{-1}) = 4.36 height – 4.55 [b] VO_{2max} (L·min^{-1}) = 0.053 weight – 0.30 [c] Female & Male: VO_{2max} (L·min^{-1}) = 4.60 height – 0.028 age – 0.62 sex – 4.31 VO_{2max} (L·min^{-1}) = 3.20 height – 0.024 age + 0.019 weight – 0.49 sex – 3.17 VO_{2max} (L·min^{-1}) = 2.5 height – 0.023 age + 0.019 weight + 0.15 Lei – 0.54 sex – 2.32 [d] VO_{2max} (L·min^{-1}) = 0.83 height$^{2.7}$ x (1 – 0.007 age) x (1 – 0.25 sex) VO_{2max} (L·min^{-1}) = 0.74 VC – 1.04 [e] VO_{2max} (L·min^{-1}) = 0.306 TV + 0.08 [f]	These equations are provided in Appendix D of the book. For all equations, height is in cm, weight in kg. In equations applicable to both males and females, sex is coded 0 for males and coded 1 for females. a) For treadmill exercise, from Bruce et al., (1973) [23] and Drinkwater et al., (1975) [13]. b) For children aged 6-17 years. From Cooper & Weiler-Ravell (1984) [10]. c) For children aged 6-17 years. From Cooper et al., (1984) [12]. d) Lei = Leisure activity, coded 1-4 according to hours of activity per week. 1 = <1; 2 = 1-3; 3 = 3-6; 4 = >6. From Jones et al., 1985 [4]. e) VC = Vital capacity (litres). From Jones et al., 1985 [4]. f) TV = Thigh volume is sum of both thighs (litres). From Jones et al., 1985 [4]. As (a) are explicitly stated to be treadmill exercise, it could be assumed the remainder are based on cycle ergometry. However, as this modality of not explicitly stated, the authors cannot be assured for purposes of risk of bias and studies that cite this book are 'assumed' in relation to modality for purposes of risk of bias. As separate equations are given for each sex, applicable to both sexes, or sex offsets are included, each citation using Jones et al., 1988 [30] can be determined as sex appropriate for risk of bias. However, age cannot be given as appropriate unless exact equation (and therefore derived population) can be determined.
Mylius et al., 2019 [31]	Female: VO_{2peak} (mL·min^{-1}) = −2537.29 + (24.3 height) + (12.57 weight) + (spline function for age: estimate df 7.391) [a] Male: VO_{2peak} (mL·min^{-1}) = −2537.29 + 743.35 + (24.3 height) + (12.57 weight) + (spline function for age: estimate df 4.263) [a] Female & Male: VO_{2peak} (mL·min^{-1}) = -3039.01 + (634.32 sex) – (16.50 age) + (29.22 height) + (16.17 weight) [b] VO_{2peak} (mL·min^{-1}) = -1469 + (673.00 sex) + (16.87 age) + (−0.47 age^2) + (0.07 height^2) + (39.70 weight) + (−0.16 weight^2) [c]	Data derived from n = 4477 (3570M/907F) healthy Dutch adults and children, from 7.9 – 65.0 years (34.1 ± 11.8 years), undergoing CPET via cycle ergometry. For all equations: sex coded as 0F/1M; age in years; height in cm; weight in kg. a) Additive Model (df = degrees of freedom) b) Linear Model c) Polynomial Model

Study	Equation	Notes
Neder et al., 1999 [32]	Female: VO_{2peak} (mL·min^{-1}) = -13.7 age +7.5 weight + 7.4 height + 372 VO_{2peak} (mL·min^{-1}) = -12.7 age + 13.6 height - 170 VO_{2peak} (mL·min^{-1}) = -14.7 age + 9.5 weight +1470 VO_{2peak} (mL·min^{-1}) = -12.5 age + 6.4 weight + 5.9 height + 72.5 PA + 164 [a] VO_{2peak} (mL·min^{-1}) = -14.5 age + 8.3 weight + 5.4 height + 103.2 LT + 535 [b] VO_{2peak} (mL·min^{-1}) = -11.0 age + 67.4 PA + 18.9 LBM + 694 [a,c] VO_{2peak} (mL·min^{-1}) = -12.3 age + 53.2 LT + 21.4 LBM + 1029 [b,c] Male: VO_{2peak} (mL·min^{-1}) = -24.3 age + 12.5 weight + 9.8 height + 702 VO_{2peak} (mL·min^{-1}) = -22.8 age + 17.9 height + 207 VO_{2peak} (mL·min^{-1}) = -25.2 age + 14.3 weight + 2267 VO_{2peak} (mL·min^{-1}) = -22.8 age + 12.9 weight + 6.2 height + 132.2 PA + 289 [a] VO_{2peak} (mL·min^{-1}) = -24.5 age + 14.3 weight + 4.9 height + 197.1 LT +1113 [b] VO_{2peak} (mL·min^{-1}) = -20.5 age + 132.0 PA + 22.8 LBM + 930 [a,b] VO_{2peak} (mL·min^{-1}) = -21.5 age + 156.8 LT + 25.9 LBM +1548 [b,c]	Data derived from n = 120 (60M/60F), aged 20-80 years, undergoing cycle ergometry. For all equations, age in years, weight in kg, height in cm. a) PA = Physical activity score; sum of scores by questionnaire from Baecke et al., 1982 [33]. b) LT = Leisure time, as per Saltin & Grimby, 1968 [34]. c) LBM = Lean body mass, via skinfold measurements, as per Durnin & Womersley, 1969 [35].
Nixon et al., 2001 [36]	Unknown	No equations are provided in this manuscript. However, references are made to Godfrey et al., 1971 [21], who in turn provides data for calculating peak work capacity as a percentage of predicted.
Orenstein, 1991 [37]	Unknown	Orenstein (1993) [38] states in the preface of the book that "*This book is a compilation of presentations made at the Standards for Pediatric Exercise Testing Workshop in October 1991 in Scottsdale, AZ*". Therefore, as a 1991 book cannot be identified, it is assumed that the 1991and 1993 reference are the same, and thus the same issues associated with Orenstein (1993) are applicable.

Study	Equation	Notes
Orenstein, 1993 [38]	Female: VO_{2peak} ($L{\cdot}min^{-1}$) = 0.0308806 height – 2.877 Male: VO_{2peak} ($L{\cdot}min^{-1}$) = 0.044955 height – 4.64	Equations from page 159 of reference. For both equations, height is in cm. No data available about the population or modality upon which these equations are derived. It could likely be assumed that this is from a paediatric population (as this is a paediatric textbook), however this cannot be confirmed for purposes of risk of bias. In addition, several references are made within the chapter to the Godfrey protocol, implying cycle ergometry, although again this cannot be confirmed for purposes of risk of bias.
Rowland, 1996 [39]	Female: VO_{2peak} ($L{\cdot}min^{-1}$) = 3.539 – 0.915 age + 0.104 age^2 -0.003 age^3 VO_{2peak} ($mL{\cdot}kg^{-1}min^{-1}$) = 58.90 – 1.15 age Male: VO_{2peak} ($L{\cdot}min^{-1}$) = 0.859 – 0.013 age + 0.010 age^2 VO_{2peak} ($mL{\cdot}kg^{-1}min^{-1}$) = 52.35 + 0.071 age	For all equations, age is in years. Where Rowland, 1996 [39] is cited, it is not clear which reference equations are used and therefore age, sex and modality cannot be verified for risk of bias. Those provided on the left are from Chapter 6 ('Maturation of Fitness') and could be assumed to be possible options and use children from 7-17 years of age. These equations are in turn from Krahenbuhl et al., 1985 [40], pooling data from 9307 children (5793M/3508F). This pooled data was "corrected" to treadmill values whereby cycle data was multiplied by 1.075. However, this offset factor of 1.075 appears to have been chosen as it is "*the approximate difference noted between these two modes of exercise*" – without any supporting reference, nor validating data.
Saris et al., 1985 [41]	Unknown	This study, performed on n = 131 children (62M/69F), aged 4-18 years (even ages only), performing cycle ergometry, derived normative data for VO_{2max}, comparing this data to prior studies. However, no equations are provided for prediction of VO_{2max}, and it is therefore unclear how this reference would have been utilised to derive a %predicted value.
Ten Harkel et al., 2011 [42]	Males: VO_{2peak} = (0.66 age) + 38.6	Data derived from n = 175 children (93M/82F), 8-18 years, via cycle ergometry. Statistical analyses only identified associations between VO_{2peak} and age in boys, and not girls, hence why no normative data is given for females.

Study	Equation	Notes
Ten Harkel & Takken, 2011 [43]	Females: VO_{2peak} = 41.5 Males: VO_{2peak} = (0.094 height) + 32.2	Same population and modality as per Ten Harkel et al., [42]. This reference from Ten Harkel & Takken, 2011 [43] is in response to a letter from Hager, 2011 [44] in relation to the original manuscript.
Wasserman et al., 1987 [45]	Female: VO_{2max} ($mL·min^{-1}$) = (42.8 + weight) x (22.78 – 0.17 age) [a,c,e] VO_{2max} ($mL·min^{-1}$) = height x (14.81 – 0.11 age) [a,d,e] VO_{2max} ($mL·min^{-1}$) = weight x (44.37 = 0.413 age) [b,c,e] VO_{2max} ($mL·min^{-1}$) = (0.79 height – 68.2) x (44.37 – 0.413 age) [b,d,e] VO_{2max} ($mL·min^{-1}$) = 28.5 weight + 288.1 [a,f] Male: VO_{2max} ($mL·min^{-1}$) = weight x (50.72 – 0.372 age) [a,c,e] VO_{2max} ($mL·min^{-1}$) = (0.79 height – 60.7) x (50.72 – 0.372 age) [a,d,e] VO_{2max} ($mL·min^{-1}$) = weight x (56.36 – 0.413 age) [b,c,e] VO_{2max} ($mL·min^{-1}$) = (0.79 height – 60.7) x (56.36 – 0.413 age) [b,d,e] VO_{2max} ($mL·min^{-1}$) = 52.8 weight – 303.4 [a,f]	For all equations, weight in kg, height in cm, age in years. a) Cycle ergometry b) Treadmill c) Normal weight d) Overweight e) Adults f) Children Equations for adults are from Table 1 in Chapter 6 ('Normal Values'), being derived from Bruce et al., 1973 [23], Hansen et al., 1984 [5], and a personal communication from Davis et al., 1985. Equations for children are from Figure 2 in Chapter 6 ('Normal Values') and are derived from Cooper & Weiler-Ravell, 1984 [10] and Cooper et al., 1984 [12]. Not enough information is provided in studies citing this reference to determine which equation(s) are used. However, as separate equations are given for each sex, each citation using Wasserman et al. 1987 [45] can be determined as sex appropriate for risk of bias. However, age cannot be given as appropriate unless exact equation (and therefore derived population) can be determined. Moreover, as modality is not clear, this cannot be awarded appropriate status for risk of bias.

Study	Equation	Notes
Wasserman et al., 1994 [17]	Female: VO_{2max} = (weight + 43) x (22.78 − (0.17 age) [a] VO_{2max} = 28.5 weight + 288.1 [b] Male: VO_{2max} = weight x (50.72 − 0.372 age) [a] VO_{2max} = 52.8 weight – 303.4 [b]	Not enough information is provided in studies citing this reference to determine which equation(s) are used, although these two sets provided are from Chapter 6 ('Normal Values'). Units for VO_{2max} equations on left not provided in reference. a) If using treadmill, multiply result by 1.11. Equations from Bruce et al., 1973 and Hansen et al., 1984. b) Equations for children (no age given in textbook). Data is from Cooper et al., 1984 [12] and therefore presumably based on same cohort (n = 109, 58M/51F, 6-17 years). However, the equation for females in Cooper et al., [12] is 28.5 weight + 288.2 (not 228.1, as per Wasserman et al., [17]) – presumably the same data, but cannot be verified. Weight for both equations in kg. Whilst not enough information is provided in studies citing this reference to determine which equation(s) are used, as separate equations are given for each sex, each citation using Wasserman et al. 1994 [17] can be determined as sex appropriate for risk of bias. However, age cannot be given as appropriate unless exact equation (and therefore derived population) can be determined. Moreover, as modality is not clear, this cannot be awarded appropriate status for risk of bias.
Wasserman et al., 1999 [46]	As per Wasserman et al., 1994 [17].	Only one study cites this version of Wasserman et al., [46] and the current authors query whether this was done so mistakenly. Moreover, there appears to be a small referencing error, as the 3rd edition of Wasserman et al., is actually from Lippincott Williams & Wilkins (Baltimore MD). However, reference in bibliography below is maintained as published by original authors.
Wasserman et al., 2005 [47]	As per Wasserman et al., 1994 [17].	Whilst not enough information is provided in studies citing this reference to determine which equation(s) are used, as separate equations are given for each sex, each citation using Wasserman et al. 2005 [47] can be determined as sex appropriate for risk of bias. However, age cannot be given as appropriate unless exact equation (and therefore derived population) can be determined. Moreover, as modality is not clear, this cannot be awarded appropriate status for risk of bias.

Study	Equation	Notes
Wasserman et al., 2012 [48]	Female: VO_{2peak} (L·min^{-1}) = 0.9 x weight x (0.0404 – 0.00023 x age) [a] VO_{2peak} (L·min^{-1}) = -4.9 + 0.046 x height – 0.021 x age [b] VO_{2peak} (L·min^{-1}) = -2.26 + 0.025 x height + 0.01 x weight – 0.018 x age [b] VO_{2peak} (L·min^{-1}) = 0.372 +0.0074 x height + 0.0075 x weight – 0.0137 x age [c] VO_{2peak} (L·min^{-1}) = -0.588 + 0.00913 x height + 0.02688 x weight – 0.01133 x age – 0.00012 x weight^2 [d] VO_{2peak} (L·min^{-1}) = 0.001 x height x (14.783 – 0.11 x age) + 0.006 x weight (actual – ideal) [e $] VO_{2peak} (mL·min^{-1}) = 28.5 x weight + 288.2 [f] Male: VO_{2peak} (L·min^{-1}) = 0.9 x (0.183 + 0.0114 x height + 0.0172 x weight − 0.0227 x age) [g] VO_{2peak} (L·min^{-1}) = 0.9 x weight x (0.0521 – 0.00038 x age) [a] VO_{2peak} (L·min^{-1}) = -4.31 + 0.046 x height – 0.021 x age [b] VO_{2peak} (L·min^{-1}) = -3.76 + 0.034 x height + 0.022 x weight – 0.028 x age [b] VO_{2peak} (L·min^{-1}) = 0.702 + 0.0098 x height + 0.0125 x weight – 0.0246 x age [c *] VO_{2peak} (L·min^{-1}) = -0.069 + 0.01402 x height + 0.00744 x weight + 0.00148 x age – 0.0002256 x age^2 [d] VO_{2peak} (L·min^{-1}) = 0.0337 x height – 0.000165 x age x height – 1.963 + 0.006 x weight (actual – ideal) [e † i] VO_{2peak} (L·min^{-1}) = 0.0337 x height – 0.000165 x age x height – 1.963 + 0.014 x weight (actual – ideal) [e † ii] VO_{2peak} (mL·min^{-1}) = \52.8 x weight – 303.4 [f]	All data retrieved from Chapter 7 ('Normal Values'). For all equations, height in cm, weight in kg, age in years. a) For adults, using cycle ergometry. From Itoh et al., 1990 [49]. b) For adults, using cycle ergometry. From Jones et al., 1985 [4] c) For adults, using cycle ergometry. From Neder et al., 1999 [32]. *Possible that age coefficient has been reproduced wrong in textbook as this is 24.3 in Neder et al., 1999 [32], but 0.0246 in Wasserman [48]. d) For adults, using cycle ergometry. From Gläser et al., 2010 [50]. e) For adults, using cycle ergometry. From Hansen, 2001 [*personal communication*]. For adults younger than 30 years, an age of 30 should be used. [$] Ideal weight = 0.65 x height – 42.8 [†] Ideal weight = 0.79 x height – 60.7. i. If actual weight equals or exceeds ideal weight ii. If actual weight is less than ideal weight f) For children, using cycle ergometry. From Cooper et al., 1984 [12]. g) For adults, using cycle ergometry. From Inbar et al., 1994 [51]. Source paper from Inbar et al., [51] is conducted using treadmill testing, but the equation provided by Wasserman et al., [48] claims to be for cycle ergometry. Whilst not enough information is provided in studies citing this reference to determine which equation(s) are used, as separate equations are given for each sex, each citation using Wasserman et al. 2012 [48] can be determined as sex appropriate for risk of bias. However, age cannot be given as appropriate unless exact equation (and therefore derived population) can be determined. Moreover, as modality is not clear given discrepancies in reporting noted above, this cannot be awarded appropriate status for risk of bias.

ACCP: American College of Chest Physicians; ACSM: American College of Sports Medicine; ATS: American Thoracic Society; ERS: European Respiratory Society; F: female; HR_6: heart rate in 6th minute of test; M: male; LBM = lean body mass; Lei: leisure activity; LT = leisure time; PA: physical activity; T_{max}: maximal time; TT: treadmill time; T_{170}: time at heart rate of 170 beats per minute; TV: thigh volume; VC: vital capacity; VO_{2max}: maximal oxygen uptake; W_{max}: maximal workload; W_{170}: workload at heart rate of 170 beats per minute.

REFERENCES

1 American College of Sports Medicine. *Guidelines for Graded Exercise Testing and Exercise Prescription*. 2nd ed. Philadelphia PA: : Lea & Febiger 1980.

2 Åstrand PO, Rodahl K. *Textbook of Work Physiology: Physiological Basis of Exercise*. 2nd ed. McGraw Hill 1977.

3 American Thoracic Society, American College of Chest Physicians. ATS/ACCP statement on cardiopulmonary exercise testing. *American Journal of Respiratory and Critical Care Medicine* 2003;**167**:211–77. doi:10.1164/rccm.167.2.211

4 Jones NL, Makrides L, Hitchcock C, *et al.* Normal standards for an incremental progressive cycle ergometer test. *American Review of Respiratory Disease* 1985;**131**:700–8. doi:10.1164/arrd.1985.131.5.700

5 Hansen JE, Sue DY, Wasserman K. Predicted values for clinical exercise testing. *American Review of Respiratory Disease* 1984;**129**:S49-55. doi:10.1164/arrd.1984.129.2P2.S49

6 Binkhorst RA, Saris WHM, Noordeloos AM, *et al.* Maximal Oxygen Consumption of Children (6 to 18 years) Predicted From Maximal and Submaximal Values in Treadmill and Bicycle Tests. In: Rutenfranz J, Mocellin R, Klimt F, eds. *Children and Exercise XII*. Champaign IL, USA: : Human Kinetics 1986. 227–32.

7 Binkhorst R, van't Hof M, Saris W. Maximale inspanning door kinderen; referentiewaarden voor 6-18 jarige meisjes en jongens (Maximum exercise in children; reference values for 6–18 year old girls and boys). Den Haag (The Hague): : Nederlandse Hartstichting (Dutch Heart Foundation) 1992.

8 Bongers BC, Hulzebos EHJ, Van Brussel M, *et al. Pediatric Norms for Cardiopulmonary Exercise Testing: In Relation to Gender and Age*. 1st ed. 's-Herogenbosch, the Netherlands: : Uitgeverij BOXPress 2012.

9 Bongers BC, van Brussel M, Hulzebos EHJ, *et al. Pediatric norms for cardiopulmonary exercise testing: In relation to sex and age*. 2nd ed. 's-Herogenbosch, the Netherlands: : Uitgeverij BOXPress 2014.

10 Cooper DM, Weiler-Ravell D. Gas exchange response to exercise in children. *The American Review of Respiratory Disease* 1984;**129**:S47-48. doi:10.1164/arrd.1984.129.2P2.S47

11 Åstrand P-O. Experimental studies of physical working capacity in relation to sex and age. Copenhagen, Denmark: : Munksgaard Forlag 1952. http://urn.kb.se/resolve?urn=urn:nbn:se:gih:diva-5581 (accessed 11 Aug 2022).

12 Cooper DM, Weiler-Ravell D, Whipp BJ, *et al.* Aerobic parameters of exercise as a function of body size during growth in children. *Journal of Applied Physiology* 1984;**56**:628–34. doi:10.1152/jappl.1984.56.3.628

13 Drinkwater BL, Horvath SM, Wells CL. Aerobic power of females, ages 10 to 68. *Journal of Gerontology* 1975;**30**:385–94. doi:10.1093/geronj/30.4.385

14 Shephard RJ. World standards of cardiorespiratory performance. *Archives of Environmental Health* 1966;**13**:664–72. doi:10.1080/00039896.1966.10664637

15 Edvardsen E, Hansen BH, Holme IM, *et al.* Reference values for cardiorespiratory response and fitness on the treadmill in a 20- to 85-year-old population. *Chest* 2013;**144**:241–8. doi:10.1378/chest.12-1458

16 ERS Task Force on Standardization of Clinical Exercise Testing, Roca J, Whipp BJ, *et al.* Clinical exercise testing with reference to lung diseases: indications, standardization and interpretation

strategies. ERS Task Force on Standardization of Clinical Exercise Testing. European Respiratory Society. *European Respiratory Journal* 1997;**10**:2662–89. doi:10.1183/09031936.97.10112662

17 Wasserman K, Hansen JE, Sue DY, *et al. Principles of Exercise Testing and Interpretation*. 2nd ed. Philadelphia PA: : Lea & Febiger 1994.

18 Blackie SP, Fairbarn MS, McElvaney GN, *et al.* Prediction of maximal oxygen uptake and power during cycle ergometry in subjects older than 55 years of age. *The American Review of Respiratory Disease* 1989;**139**:1424–9. doi:10.1164/ajrccm/139.6.1424

19 Fairbarn MS, Blackie SP, McElvaney NG, *et al.* Prediction of heart rate and oxygen uptake during incremental and maximal exercise in healthy adults. *Chest* 1994;**105**:1365–9. doi:10.1378/chest.105.5.1365

20 Froelicher VF, Allen M, Lancaster MC. Maximal treadmill testing of normal USAF aircrewmen. *Aerospace Medicine* 1974;**45**:310–5.

21 Godfrey S, Davies CTM, Wozniak E, *et al.* Cardio-respiratory response to exercise in normal children. *Clinical Science* 1971;**40**:419–31. doi:10.1042/cs0400419

22 Gulmans V, de Meer K, Binkhorst R, *et al.* Reference values for maximum work capacity in relation to body composition in healthy Dutch children. *European Respiratory Journal* 1997;**10**:94–7.

23 Bruce RA, Kusumi F, Hosmer D. Maximal oxygen intake and nomographic assessment of functional aerobic impairment in cardiovascular disease. *American Heart Journal* 1973;**85**:546–62. doi:10.1016/0002-8703(73)90502-4

24 Hermansen L. Oxygen transport during exercise in human subjects. *Acta Physiologica Scandinavica Supplementum* 1973;**399**:1–104.

25 Jones NL, Campbell EJM. *Clinical Exercise Testing*. 2nd ed. Philadelphia, PA: : W.B. Saunders 1982.

26 Åstrand PO. Human physical fitness with special reference to sex and age. *Physiological Reviews* 1956;**36**:307–35. doi:10.1152/physrev.1956.36.3.307

27 Åstrand I. Aerobic work capacity in men and women with special reference to age. *Acta Physiologica Scandinavica Supplementum* 1960;**49**:1–92.

28 Lange-Anderson K, Shephard RJ, Denolin H. Fundamentals of Exercise Testing. Geneva, Switzerland: : World Health Organization 1971.

29 Shephard RJ. *Endurance Fitness*. Toronto, Canada: : University of Toronto Press 1969.

30 Jones NL. *Clinical Exercise Testing*. 3rd ed. Philadelphia PA: : W.B. Saunders 1988.

31 Mylius CF, Krijnen WP, van der Schans CP, *et al.* Peak oxygen uptake reference values for cycle ergometry for the healthy Dutch population: data from the LowLands Fitness Registry. *ERJ Open Research* 2019;**5**:00056–2018. doi:10.1183/23120541.00056-2018

32 Neder JA, Nery LE, Castelo A, *et al.* Prediction of metabolic and cardiopulmonary responses to maximum cycle ergometry: a randomised study. *European Respiratory Journal* 1999;**14**:1304–13. doi:10.1183/09031936.99.14613049

33 Baecke JA, Burema J, Frijters JE. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *The American Journal of Clinical Nutrition* 1982;**36**:936–42. doi:10.1093/ajcn/36.5.936

34 Saltin B, Grimby G. Physiological analysis of middle-aged and old former athletes. Comparison with still active athletes of the same ages. *Circulation* 1968;**38**:1104–15. doi:10.1161/01.cir.38.6.1104

35 Durnin JV, Womersley J. The relationship between skinfold thickness and body fat in adults of middle age. *The Journal of Physiology* 1969;**200**:105P-106P.

36 Nixon PA, Orenstein DM, Kelsey SF. Habitual physical activity in children and adolescents with cystic fibrosis. *Medicine and Science in Sports and Exercise* 2001;**33**:30–5. doi:10.1097/00005768-200101000-00006

37 Orenstein DM. Assessment of exercise pulmonary function. In: Rowland TW, ed. *Pediatric Laboratory exercise Testing: Clinical Guidelines*. Champaign IL, USA: : Human Kinetics 1991. 141–63.

38 Orenstein DM. Assessment of Exercise Pulmonary Function. In: Rowland T, ed. *Pediatric Laboratory Exercise Testing*. Champaign IL, USA: : Human Kinetics 1993. 141–63.

39 Rowland TW. *Developmental Exercise Physiology*. Champaign IL, USA: : Human Kinetics 1996.

40 Krahenbuhl GS, Skinner JS, Kohrt WM. Developmental aspects of maximal aerobic power in children. *Exercise and Sport Sciences Reviews* 1985;**13**:503–38.

41 Saris W, Noordeloos A, Ringnalda B, *et al.* Reference Values for Aerobic Power of Healthy 4- to 18-Year-Old Dutch Children: Preliminary Results. In: Binkhorst R, Kemper H, Saris W, eds. *Children and Exercise XI*. Champaign IL, USA: : Human Kinetics 1985. 151–60.

42 Ten Harkel AD, Takken T, Van Osch-Gevers M, *et al.* Normal values for cardiopulmonary exercise testing in children. *European Journal of Cardiovascular Prevention & Rehabilitation* 2011;**18**:48–54. doi:10.1097/HJR.0b013e32833cca4d

43 Ten Harkel AD, Takken T. Normal values for cardiopulmonary exercise testing in children. *European Journal of Cardiovascular Prevention & Rehabilitation* 2011;**18**:676–7. doi:10.1177/1741826711410517

44 Hager A. Normal values for cardiopulmonary exercise testing in children. *European Journal of Cardiovascular Prevention & Rehabilitation* 2011;**18**:675–675. doi:10.1177/1741826711410822

45 Wasserman K, Hansen JE, Sue DY, *et al. Principles of Exercise Testing and Interpretation*. 1st ed. Philadelphia PA: : Lea & Febiger 1987.

46 Wasserman K, Hansen JE, Sue DY, *et al. Principles of Exercise Testing and Interpretation*. 3rd ed. Philadelphia PA: : Lea & Febiger 1999.

47 Wasserman K, Hansen JE, Sue DY, *et al. Principles of Exercise Testing and Interpretation*. 4th ed. Philadelphia PA, USA: : Lippincott Williams & Wilkin 2005.

48 Wasserman K, Hansen JE, Sue DY, *et al. Principles of Exercise Testing and Interpretation*. 5th ed. Philadelphia PA: : Lippincott Williams & Wilkin 2012.

49 Itoh H, Taniguchi K, Koike A, *et al.* Evaluation of severity of heart failure using ventilatory gas analysis. *Circulation* 1990;**81**:II31-37.

50 Gläser S, Koch B, Ittermann T, *et al.* Influence of age, sex, body size, smoking, and beta blockade on key gas exchange exercise parameters in an adult population. *European Journal of Cardiovascular Prevention and Rehabilitation* 2010;**17**:469–76. doi:10.1097/HJR.0b013e328336a124

51 Inbar O, Oren A, Scheinowitz M, *et al.* Normal cardiopulmonary responses during incremental exercise in 20- to 70-yr-old men. *Medicine and Science in Sports and Exercise* 1994;**26**:538–46.